

Development of a Novel Self-enclosed Sample Preparation Device for DNA/RNA Isolation in Space

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Modern biology techniques present potentials for a wide range of molecular, cellular, and biochemistry applications in space, including detection of infectious pathogens and environmental contaminations, monitoring of drug-resistant microbial and dangerous mutations, identification of new phenotypes of microbial and new life species. However, one of the major technological blockades in enabling these technologies in space is a lack of devices for sample preparation in the space environment. To overcome such an obstacle, we constructed a prototype of a DNA/RNA isolation device based on our novel designs documented in the NASA New Technology Reporting System (MSC-24811-1/3-1). This device is self-enclosed and pipette free, purposely designed for use in the absence of gravity. Our design can also be modified easily for preparing samples in space for other applications, such as flowcytometry, immunostaining, cell separation, sample purification and separation according to its size and charges, sample chemical labeling, and sample purification. The prototype of our DNA/RNA isolation device was tested for efficiencies of DNA and RNA isolation from various cell types for PCR analysis. The purity and integrity of purified DNA and RNA were determined as well. Results showed that our developed DNA/RNA isolation device offers similar efficiency and quality in comparison to the samples prepared using the standard protocol in the laboratory.